IS 12240-2 (1988): Methods of test for polyvinyl chloride boots, Part 2: Determination of durometer hardness Shore A [CHD 19: Footwear]

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(Reaffirmed 2002)

Indian Standard

METHODS OF TEST FOR POLYVINYL CHLORIDE BOOTS

PART 2 DETERMINATION OF DUROMETER HARDNESS, SHORE A

Footwear Sectional Committee, CDC 40; Measurement Sampling and Testing Subcommittee, CDC 40 : 2 [Ref : Doc : CDC 40 (9315)]

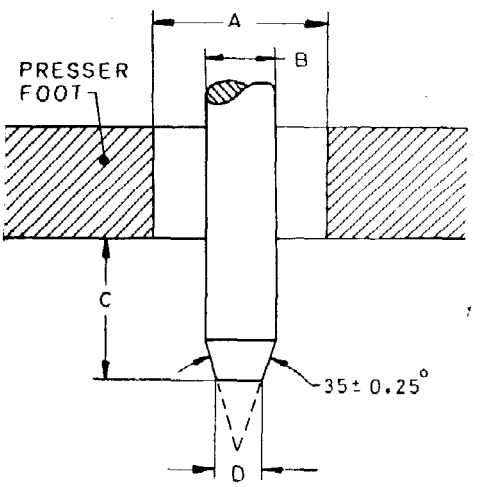
1. Scope — This standard (Part 2) prescribes the test procedure for determination of the durometer hardness, Shore A of the components for polyvinyl chloride boots.

2. Apparatus

2.1 The durometer, Type A consists of the following components:

a) Presser foot, with a hole between 2·5 and 3·5 mm in diameter, centred at least 6 mm from any edge of the foot.

b) Indenter, formed from a hardened steel rod between 1·10 and 1·40 mm in diameter to the shape and dimensions shown in Fig. 1 for Type A durometers.



$A = \phi\ 3 \pm 0{\cdot}5$ mm
$B = \phi\ 1{\cdot}25 \pm 0{\cdot}15$ mm
$C = \phi\ 2{\cdot}50 \pm 0{\cdot}04$ mm
$D = \phi\ 0{\cdot}79 \pm 0{\cdot}03$ mm

FIG. 1 INDENTER FOR TYPE A DUROMETER

c) Indicating device, for reading the extent of protrusion of the point of the indenter beyond the face of the presser foot; this may be read directly in terms of units ranging from zero, for full protrusion of 2·50 ± 0·04 mm to 100, for nil protrusion obtained by placing the pressure foot and indenter in firm contact with a flat piece of glass.

d) Calibrated spring for applying force to the indenter in accordance with the following equation:

$$\text{Force in gram} = 56 + 7{\cdot}66\ H_A$$

where H_A is hardness reading on Type A durometer.

3. Test Piece

3.1 For the determination of hardness by Type A Shore durometer, the test piece should be at least 5 mm thick and of convenient area. A test piece may be composed of thinner layers to obtain the necessary thickness, but determinations made on such test pieces may not agreee with those made on one-piece test pieces because the surfaces between plies may not be in complete contact with

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each other. The dimensions of the test piece should be sufficient to permit measurements at least 12 mm away from any edge, unless it is known that identical results are obtained when measurements are made at a lesser distance from an edge. The surface of the test piece should be flat over an area sufficient to permit the presser foot to be in contact with the test piece over an area having a radius of at least 6 mm from the indenter point. Satisfactory hardness determinations cannot be made on rounded, uneven or rough surfaces.

4. Conditioning of Test Piece

4.1 Test should be made at 27 ± 2°C and relative humidity of 65 ± 5 percent [*see* IS : 196-1966 'Atmospheric conditions for testing (*revised*)'].

The durometer and test pieces should be conditioned at the temperature of test for at least sixteen hours before testing.

Note — When a durometer is moved from a location below room temperature to a location with a higher temperature, it should be placed in a suitable desiccator or airtight container immediately upon removal and allowed to remain there until the temperature of the durometer is above the dew point of the air in the new environment.

5. Procedure

5.1 *Calibration* — The spring of the durometer is calibrated by supporting the durometer in a vertical position and resting the point of the indenter on a small spacer at the centre of one pan of a balance as shown in Fig. 2, in order to prevent interference between the presser foot and the pan (*see* Note below). The spacer has a small cylindrical stem approximately 2·5 mm in height and 1·25 mm in diameter, and is slightly cupped on top to accommodate the indenter point. The mass of the spacer is balanced by a weight on the opposite pan of the balance. Weights are added to the opposite pan to balance the force on the indenter at various scale readings. The measured force should be equal to the force calculated by equation given in **2.1** (d) within ± 8 g.

Note — Instruments specifically designed for calibration of durometers may be used. Balance or instruments used for calibration should be capable of measuring or applying a force on the point of the indenter within 0·4 gf for Type A durometer.

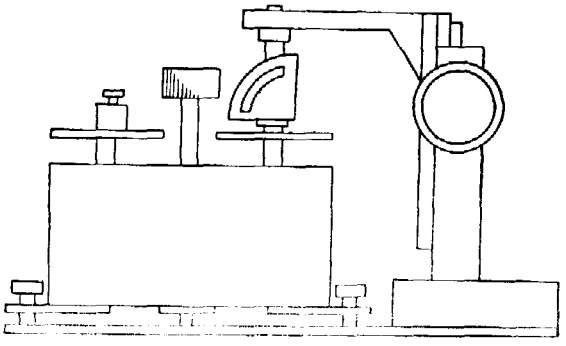

FIG. 2 APPARATUS FOR CALIBRATION OF DUROMETER SPRING

5.2 Place the test piece on a hard horizontal, plane surface. Hold the durometer in a vertical position with the point of the indenter at least 12 mm from any edge of the test piece. Apply the presser foot to the test piece as rapidly as possible, without shock, keeping the foot parallel to the surface of the test piece. Apply just sufficient pressure to obtain firm contact between presser foot and test piece (*see* Note below). Read the scale after 15 ± 1 seconds. If an instantaneous reading is specified, read the scale within one second after the presser foot is in firm contact with the test piece.

Note — Better reproducibility may be obtained by using either a durometer stand or a weight centred on the axis of the indenter, or both, to apply the presser foot to the test piece. Recommended mass is 1 kg for the Type A durometer.

5.3 Make three measurements of hardness at different positions on the test piece at least 6 mm apart and determine the mean value.

6. Report

6.1 The report shall state the following:

a) Hardness of the material, and

b) The individual test results.

EXPLANATORY NOTE

The prescribed method measures the penetration of a specified indenter forced into the material under specified conditions. The indentation hardness is inversely related to the penetration and is dependent on the modulus of elasticity and the viscoelastic properties of the material. The shape of the indenter and the force applied to it, influence the results obtained so that there may be no simple relationship between the results obtained with one type of durometer and those obtained with either another type of durometer or another instrument for measuring hardness.

IS : 12240-1988 Methods of test for polyvinyl chloride boots has been published in various parts as follows:

Part 1 Measurement of thickness;

Part 2 Determination of durometer hardness, Shore A;

Part 3 Determination of relative density;

Part 4 Determination of volatility;

Part 5 Determination of lead content;

Part 6 Determination of tensile strength and elongation at break;

Part 7 Flexing test resistance to cut growth for soling material; and

Part 8 Resistance to flexing for polyvinyl chloride upper material.

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